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NATIONALISATION AND GAS PRICES

IN the light of current commitments and plans for the future area Boards are revising gas prices, almost without exception in the upward direction, and in many cases the increases are far from small. Critics of nationalisation contend that nationalisation *per se* is the cause of what they argue are excessive increases in cost per therm to the public. A fairer view, in our opinion, gives due weight not only to the vastly greater costs of labour and materials than obtained pre-war, not only to the fact that much plant in sore need of renewal or repair is being replaced or made serviceable, not only to the new schemes for better gas service designed to cope with demand which are under way, but to the all important fact that all area Boards are under statutory obligation to be self supporting.

Addressing members of the National Association of Local Government Officers recently the Chairman of the Wales Gas Board, Mr. T. Mervyn Jones, who was speaking in general terms, remarked that there had been far too many instances of area Boards finding that municipal authorities had refused to revise their price structure in the light of actual costs and had been content to permit gas consumers to be subsidised by the ratepayers. As an addendum to this we would say that in the past that part of the gas industry municipally owned has in far too large a measure subsidised the rates out of its theoretical profits. At the same time we agree that it was inevitable that the price of gas must rise, quite irrespective of nationalisation. Increased cost of coal—and coal accounts for 60% of the gas industry's expenditure—would alone have necessitated higher gas charges.

On the privately-owned side of the industry considerable prominence has been given in the national Press to the specific case of the former Bath Gas Company, which for so many years was renowned for its low charges. The issue was raised in *The Times* by Mr. I. J. Pitman, Conservative Member for Bath, who wrote of the distress experienced by his constituents following an increase in the price of gas by the South Western Gas Board of 3d. a therm, representing an increase of 37½% on the lowest prices ruling in Bath before nationalisation. Surely, remarked Mr. Pitman, the Socialist promise that public ownership of gas undertakings would lower charges (he quoted from the Socialist pamphlet 'Let Us Face the Future') has been falsified in the event. An entirely non-political reply was forthcoming in a letter which *The Times* published from Mr. W. N. Curtis, Secretary and Solicitor to the South Western Gas Board. The essence of this letter is to be found in the following quotation from it:—'In addition to increasing considerably capital expenditure during the three years prior to nationalisation, the Bath Gas Company in 1948 approved very heavy expenditure with the object of renewing existing plant. The revenue charges arising from this expenditure, when added to the deficiency of income on the vesting date, would, in any event, have resulted in an increase of approximately 3d. a therm if the undertaking was to pay its way.' We mention the Bath Gas Company because it has received prominent publicity and not because we agree or disagree with the 3d. increase. As we have indicated announcements of price increases have been general. Today, for example, we record the increases to be made next month by the South Eastern Gas Board—additions ranging from a fraction of a penny to 2½d. a therm. And the reasons? The cost of coal; extra money needed for the renewal and maintenance of plant owing to war-time arrears; and 'not all the undertakings taken over by the Board were paying their way, but the Board is required to do so.' Also in this issue of the *Journal* is an announcement by the West Midlands Gas Board covering increases in a number of districts ranging from 0.4d. to 3.5d. a therm. In an explanatory note the Board states that there were boards of directors and gas committees who appreciated that their responsibility would cease on May 1, and were not inclined to expend money on major repairs, renewals, and replacements as they would otherwise have done; and consequently heavy expenditure will be required if the Board is to fulfil its obligations. We also publish increases in price by the North Eastern Gas Board. In point of fact we had general warning of price increases as long ago as February last—three months prior to nationalisation. The current transformation of warning into effect should not be allowed to cloud issues.

RESEARCH IN THE FIELD

MENTION was made at the end of one of our recent editorials of work of research, or investigation, waiting to be done 'in the field,' and in particular to those further economies to be effected in carbonising plant to some of which Mr. L. J. Clark has called attention (*Journal* of Aug. 10, p. 362). The old adage that profits are made in the retort house was perhaps an exaggeration, but it remains true that if gas is not made at as low a cost as possible the selling of it is handicapped at the start. And the high price of coal, of labour, and of the plant itself renders it still more imperative that economy must be driven to the limit.

Any present day study of retort house efficiency must go back to Dr. S. Pexton's little classic of 1943 on the fuel requirement of carbonising plants, read, be it noted, to a Junior Association. It began by insisting on the necessity to reduce this fuel requirement to the minimum and it rejected uncompromisingly the excuse that wast heate can be redeemed by recovery in the form of steam. 'Excessive quantities of waste heat in any form—*i.e.* heat unused in the carbonising process—will soon be regarded as an anachronism.' And surprisingly little heat is actually required

for the carbonisation process ; Dr. Pexton even assumed that the carbonisation of mixed Durham coal is thermally neutral. Heat is lost in the producer itself, by radiation from the retort bench brickwork and fittings, in sensible heat not entirely recovered from the coke even with steaming, and in the hot crude gas as it leaves the retort.

The rotary grate producer from which the gas is used was credited with an efficiency of 76.6% as against the hot-gas step-grate producer with an efficiency of 87.4%. But the dry ashes withdrawn from the step-grate producer contained 28% carbon as against 10.5% in those from the mechanical producer. The mechanical producer, however, was fed with a somewhat poorer fuel, one part breeze to two of coke, with a combustible content of 87.2% as against the run of retort coke fed to the step grate with a combustible content of 88.5%. The net loss (by radiation, &c.) in the mechanical producer was about half that in the step-grate, largely because it was trapped in the water jacket and returned to the fire in the form of steam.

The question to be investigated is whether it would not be more economical, overall, to feed the new hot-gas mechanical producers, now being built with carbonising plant, with a high grade coke. Dr. Pexton himself suggests that the smallest sizes of coke (breeze) can probably be more efficiently utilised for steam raising in chain grate boilers than for the manufacture of producer gas for heating retorts. Chain grates now being fitted to Lancashire boilers are dealing admirably with fuels much worse in quality than ordinary gasworks breeze and quite as small in grading. The use of breeze in hot-gas producers tends to increase the quantity of dust carried forward to the setting. A dust settling chamber has been used with some success, but there is room for trials and investigation to arrive at the best shape of the surfaces over and the passage through which the gases must pass to extract the maximum of dust. More positive means of dust extraction are probably impracticable and certainly undesirable if they make serious inroads into the heat content of the gas.

The next point is that of the more effective insulation of settings. It is probably a question of discovering and perfecting an insulating brick which shall have a mechanical strength equal, or nearly equal, to that of a firebrick with insulating properties not too much below those of the present day diatomaceous brick, a problem which is no doubt still engaging the attention of the Ceramic Research Association. Loss of heat from metallic fittings is more difficult. Designers avoid these as far as possible. Some heat carried away by the crude gas in unavoidable. In horizontals with the Congdon standpipe this heat is transferred quickly to the liquor but it still remains a loss to the system. In continuous verticals the temperature of exit gases is the higher when steaming is excessive—that is to say, when the proportion of unconverted steam is high. Spraying near to the offtake reduces radiation at this point but loss of heat is not thereby reduced. Temperatures round the top of the retort within the setting cannot be reduced below a certain limit, but have we reached that limit yet?

A certain amount of heat must leave the setting with the waste gases ; its quantity is, of course, the product of the irreducible temperature and the weight of the gases, the latter strictly proportional to the fuel consumption. Its recovery in the waste-heat boiler has the disadvantages set out by Dr. Pexton. There are the two alternatives, the waste-gas turbine of which a trial is now in hand, and a return to the recuperator. The recuperator was abandoned in the design of the continuous vertical mainly because when built of brickwork it was inevitably bulky and, owing to lack of gas-tightness, inefficient. Moreover the system of recuperation within the setting itself, the heating of secondary air by the residual heat of the outgoing coke, and the transfer of heat from the waste-gases to the incoming charge, is singularly effective. Dr. Pexton's suggestion that still more of the heat from the coke should be recovered and also used for heating primary air to producers is one that should be investigated and tried out in working installation.

The possibilities of a metallic recuperator are, however, worthy of further investigation. A trial of some duration has already been made on an intermittent vertical plant in Holland. The difficulty was to find an alloy of which tubes could be made which would stand up to 1,000° C. in sulphur-rich gases. Tubes were made, solid drawn, in a chromium-aluminium-silicon steel which had stood for some three years in a similar atmosphere in recuperators applied to other industrial processes. In order to do so they were, in a very ingenious manner, relieved of their own weight. The arrangement, added to an installation not designed to accommodate it, was not particularly convenient, but the results were certainly such as to justify a trial under more favourable conditions. The advantages, obviously, of the metallic recuperator are its relatively small bulk and its gas-tightness, as well as the very rapid and effective heat transfer through the tube walls, vastly thinner than would be possible in any ceramic material.

Another very interesting practice at these works in Holland was the blending of coke breeze with the coal fed to the retorts. A good deal of such blending has been done in coke ovens, but it is possible that more could profitably be carried out in gasworks practice. More might be done, to adjust swelling troubles, by mixing ; but blending is another matter. In the Dutch works the coal was broken down pretty fine in a hammer mill, the added breeze was pulverised in a rod mill, and the two were carefully mixed mechanically. As much as 10 to 15% of breeze was effectively added in this way and, with the particular coals available, resulted in a coke of a density and fineness of texture which we have never seen elsewhere.

What we are really suggesting is that the Director of Gas Research should keep in constant contact with designers, constructors, and users of carbonsing and, indeed, all other plant. In the new régime it should be possible for him to be kept informed of all the developments going forward in the industry, all the innovations which are being introduced in the numerous new plants now being planned or installed, and that when these are ready to go into operation he should be asked to send a squad of his investigators to watch the operation and observe the results, even if not, indeed, to take an active part in the working. Dr. A. T. Green already has his men observing, somewhere, the life of refractories in one or more installations. In these ways the laboratory will be allied to the works to the very great benefit of both sides. The research worker will increase his first-hand knowledge of the difficulties, the snags, inherent in practical working; the operator will come into closer contact with the accuracy of observation which is the hall-mark of sound scientific investigation. And all 'organised carefully, but not so tightly as to throttle full intellectual and imaginative freedom'—a phrase for which we are immensely grateful to our American visitors.

FUEL SITUATION IN ITALY

According to latest reports from Italy coal stocks at the end of March totalled only about 920,000 tons and the situation was considered sufficiently serious for an emergency committee to be formed to study the situation. Arrivals of foreign coal during the first quarter were 2,089,389 tons compared with 1,892,608 for the first quarter of 1948, while production of Sardinian coal for the quarter was 221,397 tons against 242,888 tons last year. According to estimates Italian petroleum refinery production for April equalled 230,000 tons, of which the main sub-divisions were petrol 40,000 tons, gas oil 53,000 tons, fuel oil 96,000 tons, and kerosene 15,000 tons. Large additional deposits of methane have recently been discovered in the Po Valley methane zone which extends for more than 100 sq. kilometres and contains 15 wells. Present production amounts to about 250,000 cu. metres daily, but with the new deposits this should rise to 1.3 to 1.5 mill. cu. metres.

DISTRICT HEATING DEBACLE

The recent announcement that Manchester Corporation may have to abandon its £2¼ mil district heating scheme for the Wythenshawe estate will not have come as a surprise to those who have followed closely during the past two years the economic, not to mention the technical, problems involved. Designed to provide a population of some 40,000 with the basic services of heating and hot water, the Wythenshawe scheme was based on the establishment of two thermal-electric power stations located in the western and south-eastern industrial zones of the estate, servicing by interconnecting mains the intervening residential areas and the civic centre as well as the adjoining industrial zones. Utilising the latent heat in the exhaust steam of these two stations, it was estimated that the service could be made available to the householder at a weekly cost of 7s. 6d. To date some £100,000, or the equivalent of a 4d. rate, has been spent, of which more than £36,000 has gone in consultants' fees. A joint meeting of the Municipal Housing Committee and the Wythenshawe Committee has now decided to recommend to the City Council that the Ministry of Fuel and Power, the Ministry of Health, and the British Electricity Authority should be approached with suggestions that 'may keep the scheme open, if adequate assistance is given.' It is understood that two major difficulties have arisen. One is the attitude of the B.E.A. towards the tariff rate at which it would purchase current generated at the thermal-electric stations. The other is the difficulty in obtaining turbo-generators during the next four or five years. Councillor J. E. Fitzsimons, Chairman of the Wythenshawe Committee, who presided at the joint meeting, has said: 'Without assistance the scheme must be abandoned. It is the first experiment of its size and kind in the country, and the joint committee feels it is unfair that Manchester should take all the risks involved without some offer of protection from the people who benefit most, that is, the Government, as anything done here will form the basis for new town development.'

UNATTRACTIVE ALTERNATIVES

Thus there can be little doubt that the sponsors of the scheme are faced with the unattractive choice of either abandoning the scheme entirely, or of raising the charge to their tenants beyond the figure of 7s. 6d., to which, it must always be remembered, there would be added at least two or three shillings a week to cover the cost of cooking and of topping-up in severe cold spells. Council tenants are not a race apart; in common with all householders they are experiencing a rise in the cost of living, and their rents are also on the increase. It is therefore extremely doubtful whether the Wythenshawe tenants would tolerate more onerous terms, and, we imagine, the Manchester authorities must be well aware of this. The question to be asked is: Why should they tolerate a further increase? As long ago as 1947 the District Heating Committee of the Institution of Gas Engineers, in making its second report to the Institution's Autumn Research Meeting (*Journal*, Dec. 3, 1947, p. 513), expressed the opinion that the gas industry could provide a *comprehensive* service, as opposed to the *limited* service of district heating, at a capital cost less than half that needed for district heating schemes. 'It is becoming generally realised,' the Committee said, 'that this country cannot afford lavish expenditure on works of a capital nature. Published information on district heating schemes suggests that the capital expenditure on these schemes is likely to amount to about £60 per head of the population. To provide a comprehensive gas service would involve the expenditure at present day prices of about £23 per head of the population, about half of which would be needed to provide gas to supplement district heating.' At the same time the Committee made it quite clear that if district heating should prove to be better, both technically and economically, than the service which the gas industry could offer, it would be most unwise to place any hindrance in the way of its development. But, the Committee added, there was so far no evidence to suggest that either was the case. Latest developments at Wythenshawe confirm the validity of this assertion. During the past two years the gas industry has gone far by the development of whole-house heating experiments to satisfy a criticism of the Committee's Report for its lack of any examples of complete all-gas services. In these pages a few weeks ago we urged the need for an early report on the findings of the amendments to the Abbots Langley experiments, and the results of the Kensal Green experiment. Experience at Wythenshawe makes this more imperative. Meanwhile we shall await with interest the further views and actions of both the Manchester Corporation and the Ministry of Fuel and Power.

Letters to the Editor

Gas Stock Compensation

DEAR SIR,—In the editorial columns of your issue of August 17 you comment on gas corporation values and invite the views of your readers.

There are two editorial comments in your leader which seem to call for some criticism. In effect, in the first paragraph you say that there has been more 'fuss'—what a word to use!—over gas compensation than over transport and electricity because the latter have had more time to settle down and to decide whether or not to dispose of their holding. Then in the second paragraph you seem to suggest that the majority of pre-nationalisation stockholders, other than a few diehards, will wish to go on holding British Gas stock because they held private enterprise gas stock.

What evidence you have for this line of thought I do not know. I should have thought the sales of Gas stock reducing its value by 11% was proof positive that, when people had been compelled to accept a reduction in their income of anything up to 45% or had been forcibly deprived of stock with a fixed date of redemption and given a stock with lower interest and a different date of redemption, the last thing they wanted to hold would be British Gas stock.

Eighteen months ago I warned the Brighton co-partners that when nationalisation took place the market would be flooded with gas stock and they would lose at least 10% of the compensation. Well, at the present moment, through a Socialist Government, 1,200 co-partners, most of whom are probably their supporters (or were at the last election) have lost £12,000—merely because the value of Brighton stock was not settled until July 25. Unless they have sold their holdings the loss is now £19,000.

In my view the Act of Parliament clearly intended that stockholders should receive full value for their holdings. That a British Government can be capable of so treating its own citizens is one of the paramount reasons of our economic difficulties with America. Is it likely that any foreigner would hold sterling any longer than he can help when he sees the British Government acting in such a way?

I submit, Sir, that the *Gas Journal* would be performing a greater service if it joined in the swelling volume of opinion that this monstrous injustice must be rectified, rather than exhibit a mild disapproval of what you call a 'major grouse.'

Yours faithfully,

HYDE C. BURTON.

Aug. 21, 1949.

A Peculiar Position

DEAR SIR,—It would, I suggest, be interesting to know whether my own experience is shared by many other ex-secretaries in the gas industry.

Shortly after vesting date my continued service with my own undertaking was confirmed by the area Board. As the post of secretary of the legally defunct company I had previously served no longer existed, I was given the title of accountant.

About the same time I received detailed instructions from the Bank of England regarding the procedure to be followed in regard to the conversion of Gas Stocks of my old company. As far as I am aware I appointed myself 'registrar' for this work and I appointed a senior clerk to act as the second 'authorised signatory' to the various forms required by the bank.

So far as my old company is concerned I appear to be acting as unofficial liquidator of its affairs, while at the same time carrying out my duties as accountant under the new régime.

I have been quite intrigued at the peculiarity of the position which appears to have arisen, so far as I am concerned, solely on account of the fact that I did not leave my office on vesting day but stayed put. Had I been appointed as a newcomer to the staff of the area Board I venture to suggest that I should not be harnessed to three quite distinct jobs and have an official appointment which recognises only one of them.

In signing letters to the Bank of England in regard to stock conversion matters I have been very tempted to sign myself, as I trust you will pardon, my doing on this occasion,

Yours faithfully,

HONORARY REGISTRAR.

Aug. 27, 1949.

Sir Mark Hodgson, Chairman of the Northern Regional Board for Industry Sub-Committee, which has been investigating future employment prospects in north-east shipyards, where a recession is feared, has stated that the manufacture of petroleum equipment was being considered as a subsidiary industry. The Regional Board was inviting the local associations of shipbuilders, ship repairers, and engineers to discuss the matter with the Council of British Manufacturers of Petroleum Equipment.

Personal

Mr. T. B. WILSON, Distribution Superintendent at Bingley gas-works, has been appointed Divisional Industrial Gas Engineer at Middlesbrough. He was educated at Bradford Technical College and has served at Bingley for over 20 years.

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The appointment of a new Personnel Manager has been announced by Oldham and Son, Ltd., storage battery makers of Denton, Manchester, following the resignation last month of Mr. H. Darby. He is Mr. H. STANDRING, who was formerly with Cooke and Ferguson, Ltd., of Openshaw, Manchester, where as Assistant Works Manager he dealt with the administration of personnel.

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Mr. TOM BROWN, formerly Managing Director of the South Suburban Gas Company and now a part-time member of the South Eastern Gas Board, has recently been appointed a Justice of the Peace for the County of Kent and was sworn in at Maidstone on Aug. 29. Among his many other activities Mr. Brown is a member of the Bromley Management Committee of the Hospital Board and he is also acting on the Rating Assessment Appeals Committee.

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Mr. W. STEPHENSON, formerly Secretary of the Lancashire and District Coke Association, has been appointed Coke Sales Officer of the North Western Gas Board to control and co-ordinate the sale of an annual production of 2½ mill. tons of coke. Mr. Stephenson is also District Coke Representative (gas) of the Ministry of Fuel and Power for the North West Region. Before the liquidation of the Whitehaven Colliery Co., Ltd., he was Administrative Secretary to that company.

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The Minister of Fuel and Power has made the following additional appointments to the Gas Consultative Council for the Southern Area :—Mr. J. E. LAY (West Hagbourne, Didcot), Councillor C. PARSONS (Caversham, Reading), Mrs. Q. COGSWELL (Portsmouth), and Miss V. VICARS (Yateley, Camberley). Two additional appointments to the Gas Consultative Council for the Eastern Area, have also been made as follows : Mr. S. GILBERT (Vauxhall Motors, Ltd., Luton), Miss K. M. KAYE (Letchworth).

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Mr. J. S. BURGOYNE, Eastern and Midland Counties representative of Parkinson and Cowan (Gas Meters), Ltd., who has recently been suffering from ill health, is relinquishing this appointment. Mr. Burgoyne has had a lifelong experience in the gas industry and his services are being retained in a less exacting appointment which will, however, enable him to maintain contact with his many friends and associates throughout the country. Mr. Burgoyne's duties are being taken over by Mr. A. L. WEST and Mr. H. A. HOBSON, each of whom has been employed by the firm for many years as a representative in other areas.

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The management of Ascot Gas Water Heaters, Ltd., gave a farewell luncheon party to Mr. R. J. GREGG to commemorate his 16 years of service and to wish him well in his future as Publicity Manager to the Gas Council. The party consisted of his oldest colleagues of many years' standing, and Mr. F. P. S. Stammers (Executive Director) addressed those present with a diverting history of the Sales Manager's past based on the highlights of his career with Ascot. A television set was presented together with a clock and other tokens of affection and appreciation. The new Publicity Manager to the Gas Council responded to the various toasts.

Obituary

The death occurred on Aug. 26 of Mr. A. W. ROBSON, Managing Director of the Bradford Gas Engine Co., Ltd., Shipley. Mr. Robson, who was 74, was a member of Shipley Urban District Council from 1922 to 1946, being its Chairman in 1934-35, and was Chairman of the Gas Committee for many years.

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Mr. H. M. ROYLE, formerly Station Engineer at Southend, died on Aug. 24 at the age of 70. He entered the Gas Light and Coke Company's service in July, 1900, as a chemist at Beckton. In 1913 he was appointed as a senior assistant engineer at the same station, and four years later was transferred to Kensal Green works as Assistant Engineer. In 1925 he became Engineer at Kensal Green, and in 1927 Acting Station Engineer at Richmond. In 1932 he took up the appointment of Station Engineer at Southend, where he remained for 12 years. He retired from active work in September, 1946, after 46 years' service. Mr. Royle was a Fellow of the Chemical Society, and a Member of the Institution of Mechanical Engineers, and took a great interest in civic affairs in Southend. He was recently appointed a member of the North Thames Gas Board Consultative Council.

Diary

Sept. 2.—**Northern Junior Gas Association :** 'The Production of Petroleum Products, with particular reference to Lubricants,' Ian A. Howden, B.Sc., Divisional Lubricant Supervisor, Newcastle Division, Shell-Mex and B.P. Ltd., Grand Hotel, Sunderland, 2.30 p.m.

Sept. 6 and 7.—**Irish Gas Association:** Annual Meeting. Alliance and Dublin Consumers' Gas Company's Lecture Theatre, D'Olier Street, Dublin.

Sept. 8 and 9.—**Combustion Engineering Association :** Conference on the Rational Allocation of Coal, Palace Hotel, Buxton.

Sept. 8.—**Institute of Welding :** Visit to the Engineering and Marine Exhibition, Olympia.

Sept. 12-16.—**Association of Public Lighting Engineers:** Annual Meeting, Llandudno.

Sept. 12.—**Women's Gas Council :** Executive Committee, Gas Industry House, 1 p.m.

Sept. 13.—**Women's Gas Council :** Headquarters Members. Visit to the Cavendish Works (De La Rue). Leaving Gas Industry House, 2 p.m.

Sept. 15.—**North British Association:** Annual General Meeting, Music Hall, George Street, Edinburgh.

Sept. 28-29.—**Wales and Monmouthshire Association of Gas Engineers and Managers:** Annual Meeting, Cardiff. (Golf competion at Radyr Golf Club on Sept. 28; annual meeting at Engineers' Institute, Park Place, Cardiff, on Sept. 29, followed by visit to steel works of Guest Keen and Baldwins).

Sept. 29.—**Midland Association of Gas Engineers and Managers:** Visit to the works of the Midland Tar Distillers, Ltd., Oldbury.

Oct. 19.—**Society of British Gas Industries Golf Circle :** Autumn Meeting, Fulwell Golf Club, Hampton Hill, Middlesex.

Oct. 25.—**Institute of Welding :** Presidential Address of O. V. S. Bulleid, C.B.E., M.I.MECH.E. Institution of Structural Engineers, 11, Upper Belgrave Street, London, S.W.1.

COAL DEVELOPMENTS IN SCOTLAND

'There is no doubt that enormous reserves of coal exist underneath the Firth of Forth, but every mining engineer recognises that they present no easy mining proposition, because of their very great depths.' This view was expressed by Mr. G. Mullin, Area General Manager of the National Coal Board for Fife and Clackmannan, when he recently addressed the Rotary Club at Leven, Fife. It had not yet been ascertained, he said, how far the coal seams extended below the Firth of Forth. It was thought that at Wellesley colliery they had reached the axis of the basin where the coal seams began to rise again. It was probable that they cropped up somewhere at the bottom of the sea, four or five miles off the shore, but that remained to be proved. The reserves in the Wemyss coalfield were in the region of 1½ mill. tons at a practical working depth of 3,500 ft. The extent of these reserves could be visualised when it was realised that only one-tenth of that amount had been worked to the present time.

Of the coal reserves in Scotland more than one half were to be found in the Fife and Clackmannan coalfield, and of the reserves in this coalfield more than half were in the East of Fife. Within the next 20 years it was proposed to increase the output from this Eastern sub-area from 8,000 to 21,000 tons per day. At Rothes two shafts were being sunk at present to a depth of 3,000 ft., where the reserves of coal were approximately 130 mill. tons. It was expected that this colliery would come into production about 1955, with a life of 100 years, and an annual output of almost 1½ mill. tons. At the Michael colliery a reconstruction scheme was also in progress to deepen one shaft to 1,000 yd. to work the large reserves underlying the Firth of Forth by the 'horozon' system of mining. By this development it was hoped to increase output to 1½ mill. tons per annum. Future plans mentioned by Mr. Mullin included the deepening of the Frances colliery, probably beginning next year, and the establishment of a complete new colliery at either Dysart or near the present Lochead colliery, capable of giving an output of from 4,000 to 5,000 tons per day. It would be appreciated, he concluded, that the expenditure necessary to sink and equip collieries operating coal at these depths was considerable, and the first essential was, therefore, high output, with high productivity per manshift.

News in Brief

According to the Census of Industrial Production in Ireland, in 1947 the 2,131 employees in gas undertakings earned £662,051.

The Yorkshire Industrial Gas Centre, now under the North Eastern Gas Board, has removed from the Meadow Lane Gasworks, Leeds, to Bridge Street, Leeds, 2.

Plans for Converting to electricity the 391 gas-lighted Council houses in the Wakefield Rural Council area have been shelved. It is stated that at a cost of £22 10s. per house the full bill would have been £8,797 10s.

The United States Bureau of Mines has announced a significant decline of 32% in the number of fatal accidents in U.S. mines for the first half of this year compared with the corresponding period of 1948. The number of fatalities in this period has amounted to 333.

The Board of Trade has issued a list of reports on German industrial technique, which includes a survey, entitled *Heating, Ventilation, and District Heating in Germany* (B.I.O.S. 1641), obtainable either at the Sales Office of H.M.S.O., price 30s., or by post from H.M.S.O., P.O. Box 569, London, S.E.1, price 30s. 6d., post free.

The Autumn Meeting of the S.B.G.I. Golf Circle will be held on Oct. 19 on the course of the Fulwell Golf Club, Hampton Hill, Middlesex, when members will compete for the Yates Bowl. The Annual General Meeting of the Circle will be held during the day. Members of the Circle will receive the usual notices and entry forms.

The Education Committee of the Incorporated Sales Managers' Association announces that, in order to meet the demands of students, qualifying and final examinations in 'sales management' will be held in London and various provincial centres on Dec. 1, 2 and 3. Entry forms and syllabus of examination may be obtained from the Secretary, I.S.M.A., 23, Bedford Square, London, W.C.1. Closing date for entries will be Oct. 29.

Steel Output in July was at an annual rate of 12,695,000 tons, compared with 12,084,000 tons in the same month last year. In both cases production was curtailed by normal holidays. Total steel output for the seven months to date has broken the previous records established in 1948 during the same period by 431,000 tons. Pig-iron production last month was at an annual rate of 9,224,000 tons, against 8,908,000 tons in July, 1948.

Among New Equipment shown by the Alliance and Dublin Consumers' Gas Company in the Industries Section of the Dublin Horse Show were a gas cooker, a gas operated refrigerator, an Ascot water heater control unit, and Fa-Neat portable heaters. Industrial Gases (I.F.S.), Ltd., who distribute Calor gas, showed some catering equipment. These included fish fryers, coffee and tea urns, and hot cupboards, made specially for bottled gas. They also showed Ascot heating equipment made for bottled gas.

The Combustion Engineering Association has published its programme for the conference on the rational allocation of coal to be held at the Palace Hotel, Buxton, on Sept. 8 and 9. In addition to a description of the four sessions, details of which were given in the *Journal* of July 13, it contains a list of 20 papers which are to be presented. This includes two papers, one on the economics of fuel allocation, by Messrs. A. Coe, F.INST.F., and E. C. Mills, M.B.E., and the other on the mechanisation of coal distribution, by Mr. W. L. Boon, O.B.E., M.I.MECH.E., M.INST.F.

The Third International Scientific Film Congress will be held in Brussels from Sept. 30 to Oct. 5, at which delegations will meet to discuss progress on subjects of importance in relation to the international aspect of scientific films. Sub-committees will present reports on such projects as the establishment of a standard method for cataloguing and recording information about scientific films and on customs regulations in relations to the international exchange of scientific films. In conjunction with the Congress, there will be a Scientific Film Festival.

Twickenham Council's Abortive Effort to establish district heating on the Butts Farm estate is, reports the *Surrey Comet*, costing the ratepayers nearly £1,000. The consulting engineers' first report was followed by a bill for £183 10s. and the account for the second has now come in. It is for £750. In addition the Council will have to pay £37 10s. to their Parliamentary agents, who prepared the Bill that was submitted to a Committee of the House of Lords. The Committee threw the Bill out on the grounds that the whole scheme was ill-conceived. This was after the Council had adopted the proposals at the end of a long period of consultation and negotiations, and after the agreement of a public meeting, which is required by law, had been obtained.

The Registered Office of Cookers and Geysers, Ltd., is now at 33, Minster Road, London, N.W.2. (Telephone Hampstead 1459).

The Next Meeting of the Midland Association of Gas Engineers and Managers will be held on Sept. 29 and will take the form of a visit to the works of the Midland Tar Distillers, Ltd., at Oldbury. A paper will be presented at the meeting, further details of which will be issued later.

The Annual General Meeting of the Wales and Monmouthshire Association of Gas Engineers and Managers will be held at Cardiff on Sept. 28 and 29. On the former date the golf competition will take place on the Radyr Golf Club's course, and the meeting will be held on the morning of Sept. 29 at the Engineers' Institute, Park Place, Cardiff, and will be followed by a visit to the Cardiff steel works of Guest Keen and Baldwins.

The Earl of Derby was a visitor to the exhibition stand of the St. Helens undertaking (North Western Gas Board) at the Rainford Agricultural Show. 'I am deeply interested,' he said, 'in any appliance for the home which lessens the arduous labours of the housewife and is also economical. Yours is a grand exhibit. I was attracted to your stand because you had the courage to come out into the open.'

The Trade Statistics for June, 1949, just issued by the Department of Industry and Commerce in Ireland, show imports of 20,549 tons of gas coal, valued at £89,149 as against 30,719 tons valued at £131,954 in June, 1948. This brings the total of these imports for the first six months of 1949 to 108,169 tons valued at £487,815 compared with 136,361 tons, valued at £593,634 for the corresponding period of 1948.

Ayrshire Pits Will Require 4,000 additional men in the next 20 years. Announcing this at a luncheon which followed the opening of the Ayrshire Exhibition at the County Hall, Ayr, Mr. J. J. Robertson, Under-Secretary of State for Scotland, said: 'I hope it will be possible to make a formal announcement in the near future about the establishment of new communities at Coylton and Old Cumnock. I think that each of these areas will require to become towns with populations of about 20,000.'

A Novel Exhibit was entered by the Isle of Thanet (Margate) undertaking of the South Eastern Gas Board for a torchlight procession on the opening night of the annual Margate Regatta. The exhibit, a decorated lorry, was outlined with flat flame burners supplied by dissolved acetylene, and on each side of the cab was a large torch working on Calor gas. Two days later the exhibit was given a place in the carnival procession at Westgate, where it was awarded third prize—an electric toaster.

The Board of Trade has announced that Buhl Sons Co., a principal distributor in the U.S.A. of hardware and allied products, have agreed to consider offers from British manufacturers who are in a position to quote firm c.i.f. Detroit prices. Items in which the company have expressed interest include clothes dryers, furnaces, ranges, space heaters, and small appliances. All correspondence, including c.i.f. details, together with expression of willingness to send samples and/or consignment stocks, should be addressed for the personal attention of Mr. H. Pilbeam, Chief Buyer, Major Appliance Department, Buhl Sons Co., 120 Adair Street, Detroit, Michigan, U.S.A.

An Electronics Symposium is to be held by the Electronics Section of the Scientific Instrument Manufacturers' Association at the Examination Hall, Queen's Square, London, W.C.1, from Nov. 2 to Nov. 4, when a series of technical papers will be read by specialist scientists and engineers. A separate hall has been secured in the building for a comprehensive display of the latest types of British scientific and electronic instruments. Entrance to the symposium will be by ticket, covering also the exhibition, obtainable on application to the Secretary of the Association, at 17, Prince's Gate, London, S.W.7. Entrance to the exhibition only can be secured on presentation of a trade card.

With a Total Output of over 4 mill. tons, coal production for the week ended Aug. 20 was 61,000 tons higher than the previous week. It was the first time for five weeks that this total has been reached. Tonnage lost due to stoppages, holidays and other causes amounted to 191,000 tons, as compared to the 244,000 tons lost in the week ended Aug. 13, but was 76,000 tons more than the tonnage lost in the corresponding period of 1948. Manpower figures for all workers show a loss of 500 during the week ended Aug. 13 on the previous week's figure of 719,900, and the total of faceworkers also declined by 300 to 296,400. Gas production for the week ended Aug. 19 shows an increase of 128 mill. cu.ft. on the previous week, while an increase in electricity supplies of 10 mill. units is shown for the same period.

THE COST OF SELF-SUFFICIENCY

PRICE INCREASES IN THREE AREAS

PRICE increases in a number of undertakings in their areas have been announced by the South Eastern, West Midlands and North Eastern Gas Boards, to be operative from the first meter readings in September.

The South Eastern Gas Board will introduce increases varying from a small fraction of a penny to 2½d. per therm in 15 districts.

Explaining why the price of gas is being increased, the Board states that recently the price of coal has been increased and extra money is required for the renewal and maintenance of plant owing to war-time arrears. Not all the undertakings taken over by the Board were paying their way, but the Board is required to do so. It has sought to spread the increases of prices as evenly as possible, but has tried to avoid increasing prices where these are already above the general level in the area.

Details of the new prices per therm with the old prices in brackets are :—

Ashford (17.25d.), 18.25d. ; Bexhill (16.75d.), 17.75d. ; Worthing (16.7d.), 17.25d. ; Telscombe and Littlehampton (17.2d.), 17.25d. ; Brighton (16.2d.), 16.75d. ; Canterbury, Inner (14d.), 16d. ; Canterbury, Outer (14.8d.), 16.8d. ; Croydon (14.6d.), 15.5d. ; East Grinstead, Inner (14.5d.), 15.5d. ; East Grinstead, Outer (15.5d.), 16.5d.

Guildford, Town (15.25d.), 16.25d.; Guildford, Country (16.45d.), 17d. ; Haywards Heath, Inner (15.35d.), 16.25d. ; Haywards Heath, Middle (16.75d.), 17.25d. ; Maidstone, Borough (15.6d.), 17d. ; Maidstone, First Outer District (16.4d.), 17.4d. ; Margate (13.2d.), 14.5d. ; Milton (14.5d.), 17d.

Rochester, Inner (14d.), 15d. ; Rochester, Outer (16d.), 17d. ; Tonbridge, Urban (15.65d.), 16.65d. ; Tonbridge, Rural (17d.), 17.5d. ; Tunbridge Wells, Inner (16d.), 17d. ; Crowborough (17d.), 17.5d. ; Wateringbury (16d.), 17d.

The Board has further announced an increase in the existing commodity charge under the two-part tariff system for both domestic and industrial consumers in its Metropolitan Division, the area of the former South Metropolitan Gas Company. From the first meter readings on or after Sept. 12 the charge will be 11d. per therm instead of the existing 10.25d. Consumers are given the opportunity to change to the flat rate system if they so desire.

West Midlands Statements

The West Midlands Gas Board has found it necessary to increase the price of gas supplied by 49 of the 71 undertakings which comprise the seven divisions for which the Board is responsible. The increases vary from a fraction of a penny to 3½d., the average increase being just over 1d. per therm.

The Board says, in a statement on the position, that an examination of the individual budgets which have been completed by all the undertakings has shown a number of causes for the price increases which have a varying effect on each undertaking. The increase in the price of coal due to the revision of the National Coal Board's schedule amounts to little or nothing in the case of some districts, whereas in others it is an onerous burden and, at Stoke-on-Trent, it is no less than £29,000 per annum, plus the consequential increase in the price of coke oven gas.

An examination of the budget reveals that some Gas Committees have apparently concluded their accounts under the old régime with a most satisfactory year but, among the items on the credit side in the revenue account, are to be found substantial war damage payments and windfalls of a similar nature which are non-recurrent. Others, on the other hand, were incurring losses and, with the imminence of nationalisation, no attempt appears to have been made to take steps to remedy the deficiency. Fortunately the majority of the works and the plant are in good order and some in first-rate condition but, on the other hand, there were Boards of Directors and Gas Committees who were not inclined to expend money on major repairs, renewals and replacements. Consequently heavy expenditure will be required if the Board is to fulfil its obligations.

The residual market has suffered some recession, in consequence of which it has been found necessary to write down tar stocks somewhat heavily, and this item alone makes itself felt in most of the budgets. For example, at Coventry the decrease is likely to be £24,000, and at Birmingham, £80,000.

All local authority owned undertakings were financed by loans which were issued under stringent conditions which required them to be amortised within a given time. This provided a full and effective method of depreciation which was denied to the Company undertakings, who were expected to provide depreciation by various methods of accountancy. One way was to set aside a calculated sum year by year which would extinguish the assets during its working life and another method was to renew the asset when it was worn out and pay for it as best as circumstances would allow from the current revenue. It is now incumbent on the area Board to depreciate all their assets in an approved manner and this charge also brings an increase in costs to those undertakings where depreciation has hitherto been a somewhat haphazard business.

The statement continues : ' The Gas Act requires that a contribution shall be made to a Central Guarantee Fund to guarantee the Gas Stock which has been issued as compensation. Moreover, each area Board must set aside something to form an Area Reserve Fund for the proper management of its business.'

The Board also points out that 60% of the gas industry's basic raw material, coal, now costs 130% more than pre-war, gas oil costs 93% more, wage rates have increased by 75% to 93%, and general materials and supplies are 150% up.

The new prices are shown in the following list with the old prices in brackets :—

No. 1 Division : Congleton (9.783d.), 10.783d. ; Leek (16.75d.), 17.25d. ; Newcastle-under-Lyme (9.787d.), 10.287d. ; Stafford (13.41d.), 14.41d. ; Stoke-on-Trent (8.882d.), 9.382d. ; Uttoxeter (16.6d.), 17.6d.

No. 2 Division : Albrighton (15d.), 16d. ; Bilston (11.5d.), 12.5d. ; Cradley Heath (10.6d.), 12d. ; Dudley and Brierley Hill (16.75d.), 17.25d. ; Halesowen (12d.), 13.5d. ; Rowley Regis (14.18d.), 15.18d.; Sedgley (9.6d.), 13.1d. ; Stourbridge (15.11d.), 16.4d. ; Tipton (13.33d.), 14.33d. ; Willenhall (12.6d.), 14.2d. ; Wolverhampton (12.4d.), 14.65d.

No. 3 Division : Cannock (18d.), 19.1d. ; Chasetown (18.4d.), 19.5d. ; Lichfield (16.75d.), 17.75d. ; Oldbury (14.3d.), 14.75d. ; Rugeley (14d.), 16d. ; Smethwick (11.83d.), 12.33d. ; South Staffs Mon. (per 1,000 cu.ft.) (16.5d.), 17.5d. ; Tamworth (18.5d.), 19.5d. ; Walsall (12.75d.), 14.75d. ; West Bromwich (12.75d.), 14.75d.

No. 4 Division : Birmingham (12.68d.), 13.68d. ; Solihull (13d.), 14d.

No. 5 Division : Coventry (14d.), 14.5d. ; Leamington (14d.), 15d. ; Nuneaton (17.75d.), 18.25d. ; Rugby (13.6d.), 14.6d. ; Stratford-on-Avon (13.3d.), 16.3d. ; Warwick (14.351d.), 15d.

No. 6 Division : Bewdley (per 1,000 cu.ft.) (79d.), 85d. ; Bromsgrove (14.894d.), 17d. ; Droitwich (15.333d.), 16.333d. ; Hereford (13.75d.), 15.25d. ; Kidderminster (12.66d.), 13.5d. ; Leominster (18.05d.), 19d.; Malvern (14d.), 14.4d. ; Redditch (14.4d.), 15d. ; Stourport (17d.), 17.75d. ; Worcester (14d.), 15d.

No. 7 Division : Iron Bridge (17.25d.), 18.25d. ; Newport (Salop) (16d.), 18d. ; Shrewsbury (13d.), 15.4d. ; Wellington (12d.), 13.5d.

North Eastern Deficiency

To cover an estimated deficiency of £575,000 for the first 11 months of working, the North Eastern Gas Board has announced an average increase in gas prices of 1.64d. a therm. Increases varying from a fraction of a penny to 3.9d. a therm will affect 62 of the Board's 79 undertakings ; 12 areas now paying abnormally high prices will have their charges reduced ; and in five areas there will be no change. The Board has emphasised that the deficiency is not caused by increased administrative costs incurred by nationalisation ; on the contrary these are less than the corresponding costs prior to vesting day. Reasons for the changes are that the cost of coal over pre-war has advanced by 175% and wages by 100%, while gas charges have only increased on average by 40%. The war caused a serious hold up in essential repair and maintenance work, which can only now be undertaken at costs which have increased by well over 150% above pre-war, and the greater demand for gas has necessitated new capital developments at many undertakings, the payments for which are beginning to be met. It is estimated that £1,600,000 will be expended during the year, almost all on projects authorised well before vesting date.

The Board has considered it wise to attempt to cover the deficiency in this year's trading. This entails that sufficient revenue must be earned during the two winter quarters to cancel a deficit arising from 11 months' operations. The price adjustments to achieve this should enable a surplus to be realised in the year 1950-51, if conditions remain stable.

The Board hope by this means to avoid more than one general price increase, to have a margin in future years which, together with anticipated economies in operation, will enable the Board, in consultation with the Gas Consultative Council, to overhaul the many gas tariff systems in operation in the area, and to improve services without further additional cost to consumers.

Under the new charges, prices will range between 14d. and 20d. per therm, compared with a present variation between 10.5d. and 28.8d. per therm. The published price per therm in the three largest towns, Leeds, Bradford and Hull, will be 14.5d. per therm, and the average throughout the area of the Board approximately 15d. per therm. In terms of actual cash, the cost of the changes to the average household will not exceed 6d. to 7d. per week, with an average extra charge of 3d. per week.

TAR AND AMMONIA OPERATIONS IN 1948

THE TREND TOWARDS CENTRALISATION

THE report for 1948 of the Chief Inspectors of Alkali, &c., Works shows that the total number of works registered under the Act was 1,083, involving the operation of 1,766 separate processes, showing a reduction of 68 works and 77 processes compared with 1947.

Most of the reductions relate to by-product operations in connection with coal carbonisation. Temporary cessation of benzole recovery accounts for 36 processes, cessation of tar distillation in favour of distillation at centralised distilleries accounts for 19 processes and abandonment of ammonia recovery for 21 processes. The policy of centralised processing and manufacture has been carried on over a number of years and although fewer works are registered than in the past, this does not mean that there has been any corresponding reduction in production. Indeed, production in most branches of the heavy chemical industry is greater than at any previous time. What has happened is that over the past two decades there has been a concentration of the industry with an increase either in the size or in the numbers, or both, of production units at the works now registered.

In 1920, 592 works were registered in England and Wales in respect of manufacture of sulphate and muriate of ammonia, the annual make being roughly 300,000 tons. Today with a production—in the main synthetic—of the order of 1,200,000 tons, registrations have fallen to 124. Gas liquor registrations, largely in respect of production of concentrated ammonia liquor, have increased from 91 to 130 with concentrated liquor production (as 25% liquor) rising from 40,000 tons per annum to about 60,000 tons. During the war production was greater and registrations also (157 in 1945). It will be seen from these figures that most of the concentrated liquor plants are small.

Plant Apt to be Neglected

Where ammonia compounds are a by-product there is at times a tendency to regard recovery as a necessary evil and in consequence plants are apt to be neglected and to lack the maintenance and supervision they need. Sulphate of ammonia plants, particularly in the portion following the saturator, and concentrated liquor plants are often very susceptible to corrosion. Ammoniacal liquor produced by the newer and more intensively worked coke ovens appears to have more corrosive properties than that from coke ovens operated at comparatively low temperatures. Stainless steel has been tried in place of cast iron for vapour and condenser pipes but with disappointing results. Trials of aluminium alloys are also being made. This corrosion problem is acute and it would seem that more research should be directed to finding a satisfactorily resistant material.

Twenty years ago 361 tar works were registered in respect of the distillation of 1,600,000 tons of tar annually. At the end of 1948, 187 workers were registered in respect of the distillation of 2,200,000 tons of tar. As the later registration figure includes some 30 works registrable under the extension to the tar works definition by the Alkali, &c., Works Order of 1935 (*e.g.*, tar acid and creosote distillation) it will be seen that there has been an appreciable concentration of the industry. Plants have operated in reasonably good order, but there was the usual batch of causes for dissatisfaction.

Progress has been made in general improvements at many works, mainly in the direction of improving foul gas disposal systems, overhaul of receiver boxes and especially in the maintenance of tight-fitting lids. Progress is also being made in the installation of sight boxes which allow the use of gastight receivers. Such improvements are especially desirable in view of the tendency to overfire and/or to oversteam pot stills.

Arrestment of fumes from pitch coolers, &c., has been reasonably satisfactory. Possibly the most difficult problem here is in connection with the particularly acrid fumes from the running-off of the hard pitch which remains after distillation of tar acids. At some works this has been overcome by enclosing the pitch bay and draughting the fumes through an oil-fed scrubber by a steam injector at the end of the system. Adoption of these means led to the cessation of complaint against one works. At another it is proposed to deal with the problem by oiling-back the pitch in the still, retaining until cool and then passing to storage for use as fuel oil. An alternative is to avoid the discharge of this hard pitch by distilling it further to coke.

It is impossible to render a tar distillery odourless. Whatever plant is installed for treatment of gases and fumes there still remains a 'background' odour due to the cumulative effect of emanations minor in themselves, from storages, odd spillages and the like, which is unavoidable and characteristic.

The following figures are abstracted from the Report, which is obtainable from the Stationery Office (9d. net):

AMMONIA

Tons. Produced at Registered Works and Government Factories	*Salts of Ammonia expressed as 25% NH_3*	*Concentrated Ammonia calculated to 25% strength*
From liquor ex Gasworks ...	94,200	51,700
From liquor ex Coke Ovens ...	178,100	21,700
From Synthetic Processes ...	875,700	1,242,400
Total	1,148,000	1,315,200

Much of the concentrated liquor was subsequently converted to salts. The total of salts plus concentrate is therefore greater than the net production of ammonia.

TONS. TAR DISTILLED AND PITCH PRODUCED

	1948	1947	1946
Tar distilled originating at :—			
Gasworks	1,343,700	1,234,000	1,161,200
Coke Ovens	826,000	767,000	769,100
Other Works	44,800	69,600	48,500
Total Tar distilled	2,214,500	2,070,600	1,978,800
Distilled or dehydrated to refined tar ...	601,000	583,600	607,600
Distilled to pitch	1,613,500	1,487,000	1,371,300
Gross pitch production	874,000	776,400	734,700
Pitch oiled back	302,000	294,300	301,400

In Scotland there was no change in the number of works manufacturing sulphate of ammonia as a by-product of coal carbonisation or shale distillation. One gas liquor plant was taken off the register as it had ceased to operate for some time. It used to produce pure aqueous ammonia from concentrated ammoniacal gas works liquor. An outlet for the liquor has been found elsewhere in sulphate of ammonia manufacture. In general, however, most ammoniacal gasworks liquor goes to waste despite the high demand for sulphate of ammonia for agriculture, economic manufacture of sulphate of ammonia from it having become a matter of great difficulty. As a result, the pollution burden on rivers, estuaries, and sewage disposal works has been increased and is likely to continue to increase with the present expansion of the gas industry as a whole.

At one sulphate of ammonia works a new type of plant was installed with arrangements for neutralising the salt with gas from the still. In operation it was found that the provisions for preventing the escape of foul gas were not adequate. They had been designed for operating conditions which were not attained in practice. As there were other operational difficulties, the management were allowed to continue running of the plant on an experimental basis. After a short period the plant was shut down to carry out modifications to the design which are to include adequate means of preventing escape of foul gas.

The tar distillation industry in Scotland continued to be active during the year although there was again a decrease in the amount of tar distilled at the small units in gas works. The bulk of the distillation is carried out in large continuous stills. By its nature dirty working conditions are inevitably associated with the industry but, where a determined effort is made, works can be kept reasonably clean with consequent all-round benefits including improvement in the atmospheric conditions near the works. On the whole, however, the provisions of the Act dealing with prevention of foul gas emission were well observed.

The following statistics relate to Scotland:

PRODUCTION OF SULPHATE OF AMMONIA

By-Product of—	1948 (tons)	1947 (tons)
Gasworks	9,207	7,492
Coke Ovens	12,560	11,605
Shale Works	17,569	15,676

In addition to the above production 313 tons ammonium carbonate was manufactured as a by-product of gasworks liquor.

PRODUCTION OF LIQUOR AMMONIA

	1948 (tons)
Concentrated crude by-product ammonia liquor (15%) ...	1,007
Pure by-product ammonia liquor (25%)	454
Synthetic ammonia (expressed as 25% liquor)	171,572

By-product liquor was converted into the salts given in the previous table. It was all of coal carbonisation origin. Some 19,636 tons of synthetic ammonia liquor was converted into salts of ammonia not given in the previous table.

DISTILLATION OF TAR AND PRODUCTION OF PITCH

	1948 (tons)	1947 (tons)
Distillation of tar derived from :—		
Gasworks	194,059	163,000
Coke Ovens	46,868	44,660
Iron Works	—	324
Pitch from tar derived from :—		
Gasworks	38,993	26,376
Coke Ovens	11,628	9,333
Iron Works	—	201

A STUDY OF PROGRESS IN THE DOMESTIC UTILISATION OF GAS*

By A. R. BENNETT, M.Sc.,
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(*Continued from p. 473*)

THE mean heat transfer coefficients in gas fires, in cooking vessels and in water heaters can be evaluated experimentally and some insight thus obtained into the working conditions in the various appliances concerned. Without attempting to minimise the value of painstaking empirical studies of this character, especially when closely related to service given to the consumer, it seems unlikely to the author that substantial technical progress can result from this approach.

It is impossible to separate convective heat-transfer studies from those of flow conditions in the system under investigation, and it frequently happens that the aerodynamic forces available to propel the hot gases through the 'scrubbing' system are the principal limiting factors in the design of heat-transfer appliances. The design problem resolves itself into maximising the heat transfer for a given pressure drop through the system. Much of the heat transfer in gas appliances occurs between solids and relatively slow-moving streams of gases, and under non-equilibrium conditions (*i.e.*, not sufficiently far from the entry to the system to permit a steady state to establish itself). The general principles of variation of heat-transfer coefficient along a surface in the direction of flow are known, but quantitative calculations are rarely reliable owing to the influence of initial turbulence, surface roughness, &c.

In water heating appliances, including kettles, the thermal resistances to heat transfer on the water faces are usually small compared with those on the gas faces, and existing knowledge is adequate to assess them to a sufficient degree of accuracy for all practical purposes. In water heating systems in which the circulation is thermal, some care in design is necessary to secure a temperature rise of the desired order. Stratification has to be minimised in the parts of the system where heat transfer takes place, and maximised in the storage cylinder. These and many other incidental problems are matters for the commonsense application of known principles, and while there is scope for an immense amount of detailed study in the cause of ultimate perfection it is fairly safe to predict that no epoch-making innovations are likely in this field.

In experimental work on appliance design the measurement of temperatures is one of the most important pieces of experimental technique, the difficulties of which have not always been fully realised in the past. During the latter part of the 19th century almost all thermometry was carried out using the mercury thermometer or in the case of temperatures outside the range of this instrument, with thermo-couples of one or two basic types immersed directly in the medium whose temperature was required. Apart from the great increase in the range of materials available for use in thermo-couples, resistance thermometers of satisfactory characteristics have been developed and applied in numerous fields. The unshielded mercury thermometer is still of considerable value in the measurement of temperatures of stirred liquids and in situations where all velocities are sufficiently high to ensure satisfactory registration. It is usually unsatisfactory in stagnant or slowly moving gases owing to the low rate of heat transfer, and such devices as the suction pyrometer, shielded thermo-couples and resistance thermometers have been introduced to ensure a substantially complete approach of the sensitive element to the ambient temperature. Full practical details of standard and proved methods adopted in Great Britain are covered by British Standard Specification and in other recent publications.

Uniformity of temperature distribution within a duct or space is difficult to achieve and is bound up with flow conditions. The technique used in averaging the thermal characteristics of non-uniform gas streams such as flue gases is somewhat complex and time-consuming. Detailed exploration of temperature and velocity distribution can be used as a cross check on other methods, but is much too tedious to be employed for routine testing and development work. This can be avoided by the use of a flue gas calorimeter in which the whole of the residual heat of the flue gases is absorbed and recorded as a rise of temperature in a stream of water flowing at a known rate.

The technique of temperature measurement in flames, difficult enough from a purely practical standpoint, is complicated by some vagueness as to what exactly is to be measured. Recent developments in the study of excited states of atoms and molecules have, however, enabled the energy relationships in flames to be expressed in rational terms. No single function corresponding to the temperature of a purely thermal molecular movement can be distinguished.

The determination of such quantities as oven and room temperatures has often been vitiated by a lack of realisation of the distinction between the temperature of an enclosure and the temperature of air or gases contained in or circulating through the enclosure. The results obtained by using a globe thermometer under such conditions can be entirely different from those recorded by an air-temperature-indicating device such as a thermo-couple or resistance grid. Unless the objectives of a particular experiment be carefully defined considerable confusion can result. For some phases of work on space heating, temperature in itself is not an appropriate criterion, and more refined instruments, such as the eupatheoscope and the thermo-integrator, have been devised to give indications correlating more closely with heat losses from the body.

Thermal measurements of a rather different character are involved in the determination of the radiant energy emission from gas-heated sources. Owing to differences in climatic conditions the interest in radiant heat sources has been considerably less on the Continent of Europe and in America, and methods of test have not therefore been studied with the same thoroughness as in Great Britain. The history of the development of appropriate methods of test in Great Britain is involved and to some extent controversial. The principal stages in the development of currently used methods are, however, the Leeds investigation of 1909, the introduction of the Richmond radiometer (1915), B.C.Y. bolometer (1915) and the integrating radiometer (1934). The work of assessing the relative merits of existing methods and instruments and of improving them where necessary has been undertaken by the Gas Research Board, and some interim results have been published.

Fluid Flow

It is primarily as the result of the stimulus given by the practical success of aircraft and turbines during the present century that the subject of fluid flow has been intensively studied and a more or less coherent, practically applicable theory has been made available. This new body of knowledge, owing little to the classical hydrodynamics of Euler and Lagrange, is still struggling to find its appropriate expression in forms which can be handled both by the mathematician and the engineer. Its application to gas appliance design is very much in its infancy, and in the author's opinion modern aerodynamic developments can make a greater contribution to progress in this field than any other relevant branch of science.

Not only is a study of air and gas flow of importance in burner design, but it is also essential for the rational design of combustion chambers, heat exchangers, flue nozzles, draught diverters, &c. The atmospheric burner, considered as an aerodynamic system with well defined boundaries and a known energy input, lends itself to fairly complete analysis.

Conditions of flow in non-aerated burners of the pin-hole type are not difficult to visualise in isolation, but when arranged in multi-jet arrays such as are commonly used in water heaters, and with combustion superimposed, many of the properties of the system which are important from a practical standpoint can only be determined empirically. Conditions of flow in flat-flame non-aerated burners are more complex and at present are only understood in a qualitative manner. There is, however, a field for the application of the illuminated-particle method to the study of the flow pattern in this case.

The conditions of flow in gases leaving the burner and during combustion and 'scrubbing' by the heat-transfer system are much more complex than in the burner body where the processes occurring are largely isothermal. Lewis, von Elbe and others whose work was recently reviewed by Culshaw and Garside have made a beginning in the analysis of flow in flames resulting from the efflux of gases in streamline flow from a straight cylindrical burner tube and other simple geometric forms. It will be evident, however, that when the resistance of a 'scrubbing' system is introduced the flow pattern changes completely and the shadowgraph and illuminated-particle methods of determining flow patterns are more difficult to apply.

A rather different class of flow problem arises in the design of ovens and other similar spaces where temperature distribution depends on the flow of hot gases through the space. For dimensional reasons the flow tends to be unstable and design is compli-

* From a paper presented to the 4th Congress of the International Gas Union, London, June, 1949

cated by lack of control over the shape, size and disposition of the contents of the space.

Apart from the lack of stability of the flow in spaces of this character, the difficulties of visualisation and measurement of three-dimensional flow patterns have hampered attempts to apply scientific principles, and consequently the design of ovens remains largely on an empirical basis. In an internally-heated oven it is usually possible to distinguish a fairly well defined primary flow pattern determined by the geometry of the burner ports, the flue and the oven furniture. Superimposed on this are various secondary flow patterns involving eddies due to sharp changes of direction, thermal circulations due to temperature gradients, and other extraneous effects. These are sometimes extraordinarily sensitive to detailed alterations and have significant effects on cooking quality. While the specialist in oven design is now armed with certain general principles which guide him in settling details of design, it is almost always necessary to put the final polish on a new product by the method of trial and error.

The subject of chimney design is in a rather separate category. Pioneer work was done by Napier Shaw, who introduced the conception that all types of pneumatic resistance could be expressed in terms of equivalent orifices. Although this basis is not theoretically sound, and has since been shown to be of very limited application, the effect of Napier Shaw's work was to stimulate thought on the factors involved, and the theory of chimneys can now be regarded as in a fairly advanced state.

In the gas industry the traditional method of flow measurement is, of course, by drum or bellows meter, and where applicable this can attain a very high degree of accuracy. For small flows the recently-introduced soap-bubble meter gives a direct reading of adequate accuracy for most experimental purposes. For the measurement of such quantities as the volume flow of hot gases, or in other cases where only a small pressure drop can be tolerated, or where the size of the necessary directly volumetric equipment would be impracticable, other methods of approach have to be adopted. Using suitable methods of sampling and averaging, a confined air flow can be measured by Pitot-static traverse or, given good entry conditions, by venturi or nozzle meter, to an accuracy of $\pm\frac{1}{2}\%$. Many workers rely upon CO_2 determinations as a measure of volume flow in products of combustion, the amount of CO_2 produced by combustion of unit volume of gas being known. In the author's opinion this method is less reliable than physical methods referred to above, as completeness of mixing must be ensured before the sample for analysis is withdrawn, or alternative and necessarily complicated means must be adopted to obtain a true average.

Many physical methods of flow measurement are sensitive to turbulence and to anomalous velocity distribution existing upstream of the point of measurement, and it is usual, therefore, to provide a straight length of ducting to permit of the establishment of normal conditions of flow. Where space is limited and such precautions are not possible, the R.A.E. annular orifice meter gives indications which are substantially independent of the conditions of air flow upstream of the meter. The so-called calorimetric method of air flow measurement involving the determination of a temperature rise resulting from the introduction of heat at a known rate, or conversely the measurement of an amount of heat required to produce a fixed rise of temperature (as in the Thomas meter) is also of value in some cases, but this method, again, introduces the question of uniformity across the cross-section of the duct, which as already indicated, is an extremely difficult condition to achieve under many practical circumstances.

In many aerodynamic problems it is velocity distribution rather than volume flow that is required to be known, and for this purpose the Pitot-static tube, the hot-wire anemometer and the illuminated-particle methods have appropriate fields of application.

Processes Affecting Durability

Corrosion has been one of the major problems of water heater design for many years, and there is little doubt that the use of gas for water heating in Great Britain has been adversely influenced by troubles arising from this source. Corrosion by flue gases is very largely due to sulphur compounds in the gas attacking the combustion chamber and flue surfaces mainly, but not entirely, in the liquid phase. The details of the corrosion process vary somewhat with the heater materials and operating conditions, and are still not fully understood.

For practical reasons the condensing type of heater has fallen into disuse, and under steady running conditions well designed modern heaters produce no condensation in any part of the combustion system. During the initial heating-up stage, however, it is inevitable that some condensation should occur, and this is when most of the corrosion takes place. The composition of the condensate initially deposited is known to depend on the flue gas concentration, on the temperature of the surface and on the sulphur content of the gases. A secondary, but by no means negligible, factor is the $SO_2 : SO_3$ ratio which recent researches have shown can be influenced by the character of the combustion. As the temperature of the combustion chamber surfaces increases, re-evaporation takes place, giving a gradually increasing concentration of H_2SO_4. The variation of the rate of corrosion with initial conditions has recently been studied in the case of tin-lead coatings on copper, and results of considerable interest and practical importance have been found. It is not, however, possible to generalise from these as to the course of the corrosion phenomena on other metals. In circulators and storage heaters a rather different approach has been adopted, resulting in the use of corrosion-resisting steel as the combustion chamber material. The best-known alloy for this purpose is an 18-8 Cr-Ni steel with an addition of 2.5% to 3.5% of molybdenum. This is the alloy to which the name 'Radaloy' has been given. It will be obvious to those familiar with the details of water heater design that the use of such a material, although advantageous from the standpoint of corrosion and temperature resistance, necessitates greater attention being given to the design of the fins to avoid loss of efficiency due to reduction in thermal conductivity as compared, for example, with copper.

One of the greatest difficulties in this type of investigation is to reproduce in the form of an accelerated life test the conditions obtaining in ordinary domestic use. Great care is needed in deciding the proportions of the whole cycle to be devoted to heating-up, running and cooling. Variations of the water inlet temperature and of the ambient air temperature can affect the results appreciably.

In the recently published work of the Gas Research Board on this subject, the conclusion was drawn that there was no advantage to be gained in reducing the sulphur content of the gases below about 3 gr. per 100 cu.ft. More recently, however, this conclusion has been disputed and this particular aspect of the matter must be regarded as *sub judice*. There is, nevertheless, no doubt that the general reduction of the sulphur content of town gas to a figure of this order would be of great advantage.

In countries where fuels of low sulphur content are naturally available the position in regard to corrosion is generally much easier. In the United States of America, for example, mild steel is commonly used as a constructional material in the flue gas passages of heating appliances. If such appliances were to be used on gases of high sulphur content such as those available in Great Britain, very rapid deterioration would result.

In addition to that arising from the occurrence of corrosion on gas faces of water heaters, considerable maintenance attention has been necessary in the past in many areas due to the deposition of hard scale on the water faces. This effect varies widely in different areas according to the source of the water, but is sufficiently general to have been a major item in the maintenance costs associated with water heaters generally and with water boiling appliances in particular. The position in this respect has been revolutionised by the introduction of the scale reducer. This consists essentially of a small container chargeable with sodium hexametaphosphate in a suitable form to ensure a slow rate of solution yielding a concentration of the order of 1 to 2 parts per mill. in the water reaching the heated portion of the system. This prevents the precipitation of scale in an adhesive form. Containers in a variety of sizes to suit the usual range of hot water requirements are now available, and it is generally recommended that a size of unit should be adopted permitting renewal of the active agent at not less than yearly intervals. An important characteristic of this method of scale reduction is that over a long period scale existing in a system prior to the introduction of the scale reducer is ultimately removed.

Reference should be made also to an alternative method by which the same effect can be produced. In this method a difference of potential is established between an electrode immersed in the water supply and the metal-work of the system. This necessitates a connection to a supply of electricity, and in the author's experience a fairly accurate adjustment of the working conditions is needed to produce results of practical value.

Considerable trouble has been experienced in the past due to corrosion of the water faces and passages in heating systems, especially in regions where appreciable amounts of chloride are present in the water. Corrosion can also be set up where dissimilar metals are in contact in the water circuit. These troubles are largely avoidable by the initial choice of suitable materials, *i.e.*, a galvanised or similar coating in hard-water districts, and copper containers and passages in districts where soft and chloride-bearing waters are encountered. It is possible to use galvanised cylinders in the latter conditions only by the use of some form of electrolytic protection based on the sacrificial corrosion of an anode of some other metal introduced into the circuit. Magnesium or its alloys are said to be satisfactory for this purpose.

In addition to the processes occurring in their interiors, gas appliances are subject to many forms of attack depending on the conditions of their installation. This applies particularly to cookers which are subjected to the action of splash and spillage containing food acids and salts. The introduction of vitreous enamel as a protection against this type of influence was made about the middle of the 19th century, the enamels then available being of the 'soft' type containing lead, but, although withstanding the conditions of domestic use better than the bare iron or steel, these materials were still subject to appreciable attack leading to loss of gloss and other disintegration. Moreover

their resistance to impact and thermal shock was not such as to permit application to the parts of the cookers where protection was most needed, namely, the hotplate bars and burners. Development in enamel finishes has therefore been directed mainly towards the introduction of harder, more adherent and heat- and acid-resistant coating. The use of lead compounds in enamels has since been abandoned for hygienic reasons, and this has increased manufacturing difficulties. The factors affecting workability of the enamel during processing (viscosity, surface tension, &c.) have therefore been increasingly studied, as also have the causes of the various defects such as pin-holing, fish scaling, &c., the local development of which can cause the rejection of an otherwise satisfactorily enamelled component.

While the chemical complexity of enamels has hitherto limited the applicability of the scientific approach and has resulted in the retention of trial and error as one of the main methods of progress, this position is gradually yielding to the application of the modern conception of atomic and molecular structure facilitated by the use of X-ray analysis and the introduction of other physical methods. Considerable progress has been made towards the formulation of general principles upon which new enamels can be compounded.

Not only in regard to chemical composition, but also in the technique of application, preparation of material and design of components to be treated, detailed study has resulted in marked improvements in the quality of the product.

Many attempts have been made to find substitutes for vitreous enamel equally resistant to the various influences mentioned above, but easier to apply to the metal to be protected. No suitable material has as yet been produced. There is undoubtedly scope for the introduction of new processes for the external surface protection of domestic appliances.

Reactions to Environmental Conditions

The physiological aspects of radiant heating have been studied in some detail, with particular reference to the effects of high-temperature radiation such as that from gas fires. The manner in which the absorption characteristics of the skin determine the effects of energy of different wavelengths is clearly understood, but in the absence of any completely satisfactory criterion of comfort the correlation of sensation with the physical conditions of heating can only be effected on a statistical basis. The transmission of radiant energy of the various wavelengths through the skin and the associated sensations have been studied with results of considerable interest by American workers. Other effects of radiation on the human body have been investigated at the J.B. Pierce Memorial Institute in addition to the effects of the factors entering into the effective temperature scale, *i.e.*, air temperature, air movement and humidity There is some disagreement regarding the specific physiological effects of energy of different wavelengths. The chief difficulty encountered in such work is the variability of individuals in regard to their reactions to different environments, and unless experiments can be conducted on a sufficient scale to enable statistical methods to be applied it is very easy to obtain misleading results. For example, the minimum air temperature at which comfort is attainable in the presence of radiation of suitable intensity has been stated to be 46°F. to 56°F. by different investigators. (See discussion.) These statements are based on experiments carried out on a number of subjects and under controlled conditions, but so little is known of the effects of acclimatisation and other possible causes of variability that it is impossible to generalise except on the basis of extremely large-scale tests.

In the references to the development of space heating appliances in the 19th century it has been pointed out that the possibility of variation in quality of both radiation and convected heat was ignored. In the case of convection the effects are relatively simple, as the variation of relative humidity with temperature of a stream of air, and the corresponding effects of drying of the throat and the mucous membrane are well known. To introduce a given quantity of heat into space in the form of hot air it is therefore desirable to associate it with a sufficiently large air flow to avoid an undue reduction of relative humidity.

The study of the physiological effects of radiant energy has had several practical repercussions on the design of gas fires. Much effort has been directed towards increasing the average radiating temperature of the source, and the selective radiation from various refractory materials has been extensively studied with this application in view. The extent to which the proportion of short-wavelength energy can be increased by raising the average radiating temperature of the source is limited, as the higher the efficiency of the appliance the lower the mean temperature at which the energy is available. It is appropriate to mention here that the limitations on attaining a desired heat output in the form of radiation are greater than those applying to convection, and where a high overall efficiency is desired it seems likely that a substantial proportion of the heat must be accepted in the latter form or in degraded forms of radiant heat of no great attractiveness from a physiological standpoint.

In space heating we are some way from achieving a panoramic view of the whole field of possibilities. The pros and cons of alternative known methods of heating are still open to debate, and it is safe to say that in existing appliances neither radiant nor convected heat exhibits its full potentialities. It seems likely that for a considerable time to come there will be a demand for both radiant and convected heat appliances, and the rational development of both types presents plenty of scope for ingenuity on the part of appliance designers.

Cooking Processes

Traditional procedure in food preparation has until recently formed the sole basis of design of cooking appliances. Although attempts have been made to relate, for example, the thermal conditions in an oven to the quality of the results attained, this has been done on a very empirical basis and no objective criterion of quality has been adopted. The scientific approach to cooking processes is of relatively recent origin, and even yet can only be said to be in the exploratory stage.

The foods we eat are of a complex chemical composition and, with few exceptions, are made up of substances which can be classified as proteins, sugar, starches, fats, mineral salts, vitamins and water. In the process of cooking, a variety of changes take place in the food, depending on the conditions and on the particular combination of characteristic substances present. In order to make the best use of foods at our disposal it is necessary not only to understand what happens to them when they are cooked in the orthodox way, but also what in scientific terms are the objectives of cookery from a dietetic standpoint. It is then possible to decide how far existing procedure departs from the ideal and whether by the traditional handing down of recipes from mother to daughter important gastronomic possibilities are being overlooked.

The main reasons for cooking meat and fish are to sterilise them and make them more appetising. The lean of meat and fish consists of muscle fibres bound together by connective tissue. When the meat is cooked the proteins in the muscle set, but the connective tissue is softened by being partially converted into gelatine. Prolonged heating in water causes most of the connective tissues to be dissolved, but adversely affects flavour owing to the solution in the cooking water of extracts containing mineral salts. For the retention or enhancement of flavour, roasting or grilling is necessary, and results are satisfactory only in the case of the more tender joints of meat taken from parts of the animal least used in muscular effort.

Meat, in common with most foodstuffs, is a very poor conductor of heat. The penetration of heat is therefore gradual, causing progressive shrinkage of tissues, meat juices being expressed and either running off or being evaporated on the surface of the meat, according to the method of cooking. About 85% of the loss is water carrying with it up to about 5% of nitrogenous matter including proteins and 0.2 to 1.5% of mineral salts. Dry methods of cooking cause less loss of both nitrogenous and mineral matter than cooking in water. The only true loss is the evaporated water, as the other matter is found either in the dripping or in the cooking medium according to the method of cooking.

The mechanism of the shrinkage of meat during cooking is not fully understood. It appears to coincide with the coagulation of the proteins, but the interdependence of the two phenomena has been disputed. The variation of loss with temperature is considerable, and this has led to the technique of cooking meat for long periods at low temperatures where the minimum of loss is desired. Loss is also materially affected by the shape and composition of the joint, up to 40% loss being recorded in adverse conditions. Contrary to what might be expected, the humidity of the oven atmosphere does not materially affect losses, but chemical effects of the products of combustion are detectable, and although these are unimportant from a dietetic standpoint, the appearance of meat thus cooked differs from that cooked in an externally-heated oven. It has, of course, to be remembered that the methods of cooking resulting in the least loss of substance are not necessarily ideal from the point of view of flavour. Thus, in the roasting of meat shrinkage is likely to be greatest while in the lower-temperature processes, involving boiling or simmering, results are generally agreed to be less attractive from a gastronomic standpoint.

Starch Foods

Analogous changes to those occurring in meat occur also in the cooking of other foodstuffs. Raw starch is practically indigestible by human beings, and must be cooked before being taken as food. When it is heated in the presence of moisture the starch grains absorb moisture and swell, rupturing the cell walls and becoming digestible in the process. When exposed to moderately high temperatures, starch is affected chemically and becomes golden brown in colour. This change is responsible for the characteristic appearance of cakes and pastry.

The detailed processes occurring during cooking of cake mixtures (*i.e.*, raising, drying, coagulation of proteins, and crust

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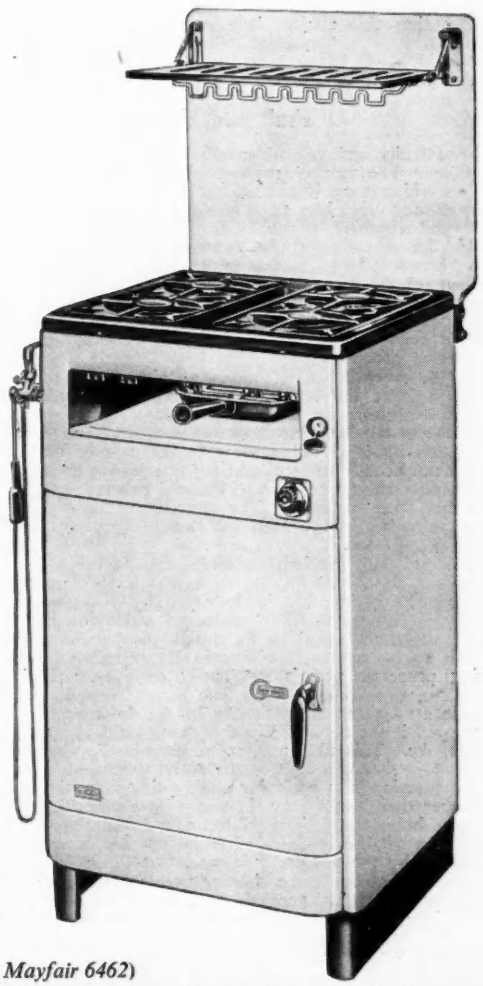

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formation) have been studied microscopically and much insight has been obtained into the contributions made by the various ingredients to the final result. By such means the effects of variation in the quality and proportions of the constituents can be followed with accuracy and improvements in technique can be expected to result from this approach. The mode and rate of transfer of heat to the food is of great importance in baking operations. In recent tests comparisons have been made of the effects of different proportions of radiant and convected heat and of differences in oven atmosphere on the quality of the product. Using ovens with internal surfaces of different emissivities, but with the same atmosphere, tests have shown that given the same overall rate of heat transfer to the food in relation to the internal rate of conduction through the mixture is, however, of great importance in determining the final form, texture and uniformity of cakes, &c. While in the recent application of high-frequency heating to cooking the necessity for transferring the heat by conduction through the relatively poorly conducting mixture is avoided as the heat is generated uniformly throughout the material, the appearance and surface texture of the product is entirely different from that produced by more orthodox methods.

In contrast to the effect on meat roasting, the composition of the oven atmosphere can have appreciable effects on the quality of cooking of starch foods, the most important factor being that of humidity. In an investigation of the effect of humidity on the cooking of scones, it was found that the shape and the nature of surface were largely determined by the rate of drying, which is dependent on temperature, velocity and relative humidity of the gases. Artificial variation in the latter quantity by introduction of steam accentuated the characteristic differences associated with internally and externally heated ovens.

Some of the earliest criticisms of gas cooking were based on the possibility of 'fumes' affecting the food, but it is only recently that this subject has been fully investigated. While sulphur dioxide is absorbed by foodstuffs, the concentrations reached are well below those regarded as permissible in commercial preservation processes.

Fruit and Vegetables

Some fruits and vegetables are cooked to make them more digestible. The nutritive material is enclosed in a framework of cellulose which is not digestible, but which is softened by cooking. When starchy vegetables such as potatoes are cooked, the starch swells and ruptures the cellulose framework, thus making it possible for us to digest the contents by allowing the digestive juices to penetrate. The cellulose itself, commonly known as roughage, passes through the body, acting as a stimulant to the digestion. The recognition of the importance of vitamins and mineral salts as constituents of the diet has led to considerable attention being devoted to the losses of these substances during the cooking process.

With the exception of vitamin *A* all vitamins and mineral salts present in fruits and vegetables are soluble in water and so are partly lost during the cooking process. If the juice is consumed the matter is of no importance apart from the slight loss due to the causes given below. In the case of vegetables, the water is not usually utilised, and for this reason the smallest possible quantity should be used so that the process is one of steaming rather than boiling. The practice of cooking vegetables in their skins is also advantageous, as salts do not diffuse through them.

With regard to the influences affecting the vitamin content of the cooked foods, vitamin *A* is normally stable to the usual processes of cooking, but is destroyed by oxidation at cooking temperature; hence the importance of excluding air from the cooking vessel and cooking as rapidly as possible if this substance is to be retained. Vitamin *B*1 is reasonably stable to cooking processes and is not easily oxidised. Disintegration takes place more rapidly when acid is not present. Vitamin *B*2 is stable at cooking temperatures in the presence of acid, but is destroyed if the cooking liquid is made alkaline by the addition of soda, &c. This also applies to vitamin *C*, which resembles vitamin *A* in that it is also destroyed by oxidation. Here again the best practice is to cook for a short time at a higher temperature rather than for a long time at a low temperature. Recent work has shown that it is possible under favourable conditions to increase the vitamin content of fruits by careful cooking. The reasons for this are still under investigation.

The use of steam in the cooking vegetables is well established commercially and its general domestic application has only awaited the development of a suitable specialised appliance. An even wider range of conditions is attainable by pressure increase, and suitable vessels are now generally available.

Setting the Course for the Future

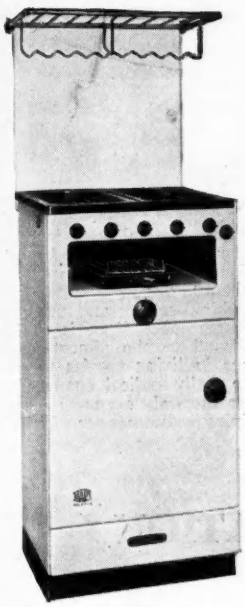
Apart from the effect of time lag it is often difficult to define the essential requirements of a situation, and in the rational design of any equipment to meet human needs, especially affecting domestic routine, which is often strongly conditioned by convention, it is necessary to go beyond the current conception of those needs to the underlying phenomena interpreted in a scientific sense. The increasing complexity of the apparatus of civilisation renders it less and less practicable to base our plans for future developments on the popular assessment of current needs. It must be obvious that in a period of rapid technical development, giving the public only what it wants can in a relative sense cause stagnation, since the horizon of the appliance used is limited by the apparatus and technique with which he is familiar and which, although probably far from ideal, he has learnt to tolerate. It is most certainly restrictive and may even be completely misleading to take current requirements as seen, for example, by the salesman, as the ultimate objective in the design of domestic, or indeed any other, appliances. Not only are real needs often inarticulate, but only a few specialists can be aware of the wider possibilities opened up by developments in pure science or in technology. What is needed, therefore, is a detailed analysis of the underlying physical and biological processes and requirements so that design can lead rather than follow public demand.

It should not be thought that the author is advocating the use of Procrustean methods on the consumer whose ultimate benefit must always be the objective. There will, of course, always be individual preference and prejudices which cannot be reduced to rational or quantitative terms and which it is necessary to take into account as real factors in the whole situation. In this direction the public relations officer, the salesman and the market research worker can make their contribution to progress. This contribution consists essentially in anticipating and removing the irrational obstacles and reducing time lag in application of desirable development. It is evident that market research in its currently accepted sense can do little more than explore the applicability of an idea that has already been crystalised and is known to the consumer. Little is gained by conducting an inquiry of consumer preferences among appliances of which the consumers have had no experience. The framing of questionnaires has, therefore, to be effected with great care; otherwise rather misleading results may be achieved. A market research department may also bring to light requirements not previously recognised, and points of design may be taken out of the realm of the individual opinion and placed on a factual basis.

There has recently tended to be an over-emphasis on the economic aspects of gas appliance development, and this has vitiated the results of attempts to assess the relative merits of different units without a clear conception of what the ultimate objective should be. For example, the aim of any domestic heating process is to secure the maximum degree of comfort for the occupants of a given space, and this can be defined only in terms of physiological and psychological considerations. The most economical system is not, therefore, necessarily acceptable in terms of the ultimate objective. The efforts which have been made from time to time to develop objective standards of comfort have only achieved partial success owing to the complexity of the inter-relation of environmental factors. Consequently, we still have to rely ultimately on individual reactions in assessing the merits of a given heating situation, with the result that traditional practices and national or regional prejudices enter largely into our judgments. It is evident, therefore, that only as a result of study on the widest possible statistical basis can generalisation safely be made. Such a basis will inevitably underly almost all well-planned field work on gas utilisation even where the conditions of investigation are partly or wholly under scientific control. Several investigations along these lines are already in hand, but it seems to the author that these have been planned on too restricted a basis. While it is useful to know how consumers use existing appliances, and what the limitations of those appliances are judged to be, one has to dig rather deeper if the foundations for long-term future development are to be laid.

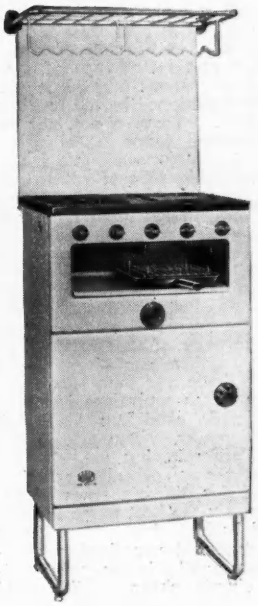
It is almost impossible to consider future possibilities in regard to appliance development without reference to cost. It would be easy to write a list of features of appliances which almost every consumer would like, but the availability of such features is bound up with what the consumer is prepared to pay for them. On the cooker as known to the American housewife many features are found which in a general sense are desirable, but which have not been introduced on corresponding products in Great Britain. There is no great difficulty in solving the technical problems of clock-controlled ovens, of internal illumination, of automatic ignition, &c. These and other similar accessories, can be designed on common-sense principles from existing knowledge. Hitherto the decision as to how far the need for such features justifies the additional cost and complication has depended largely on the salesman's assessment of what he could sell. The need for placing such decisions on a broader and more factual basis will be evident in the light of the considerations we have already outlined. One can see in general terms that other features, such as the thermostatic control of hotplate operations, are at least as desirable as control of the oven, but technical difficulties have hitherto made the cost of such an accessory prohibitive.

In addition to the universal scientific background of gas



177 with platerack and backplate; 4 boiling burner hotplate; 16″ oven; plinth base; cream/black finish.

177 with short splashplate; 3 boiling burner hotplate; 14″ oven; plinth base; dapple white finish.



177 with platerack and backplate; 3 boiling burner hotplate; 14″ oven; tubular legs; cream finish.

177 with short splashplate; 3 boiling burner hotplate; 16″ oven; cast iron legs; dapple/white finish.

CHOICE OF 177 FEATURES

Platerack and backplate, or short splashplate.

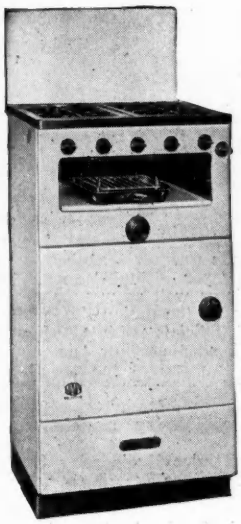
Hinged cover with shelf.

Oven heights: 14″ or 16″. (Portal, 14″ only)

Hotplates with 3 or 4 boiling burners.

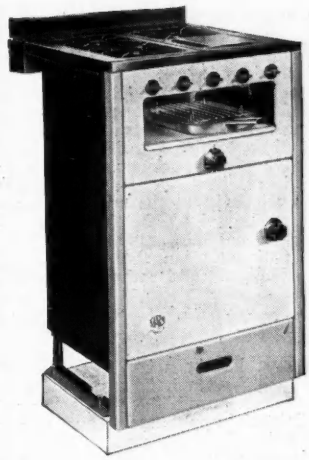
Cast iron legs; plinth base or tubular legs.

The finishes are: dapple and white, or cream and black.

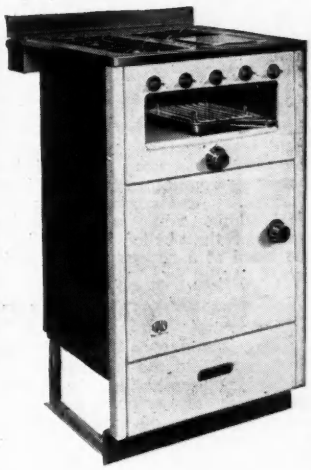


177 with short splashplate; 4 boiling burner hotplate; 14″ oven; plinth base; cream/black finish.

177 with platerack and backplate; 3 boiling burner hotplate; 14″ oven; cast iron legs; dapple/white finish.



177 Portal type with cream/green finish. (Supplied only with 3 boiling burner hotplate and 14″ oven).



177 Build-in type with 14″ oven; plinth base; cream/black finish. (Supplied only with 3 boiling burner hotplate).

R. & A. MAIN LTD., LONDON & FALKIRK

utilisation there are numerous other factors and influences which have entered into the development of gas appliances and have resulted in the great differentiation of forms and characteristics with which we are familiar. Although, as a result of almost world-wide circulation of information and interchange of ideas under modern conditions, parallel developments take place over most of the civilised world, these are conditioned by the facilities, customs and prejudices of each locality. There is not, nor can there be, any standardisation of practical forms taken by the appliances we have been considering. Major economic factors such, for example, as the relative availability of coal and natural gas, can determine the general character of gas usage in a given country and can also condition technical design of appliances to a considerable extent. (Consider, for example, the reluctance to use non-aerated burners in the United States of America as compared with Great Britain owing to the greater suitability of aerated type of burner for operation on natural gas.) Traditional modes of heating linked, as they obviously must be, with climatic conditions have undoubtedly exercised a decisive influence on appliance design. In the parts of the world where climatic conditions are extreme the extensive use of convection for heating has been established, while in the more temperate regions radiation from an open fire or its equivalent has been found adequate in the past. Climatic conditions also limit the applicability of some sources of power. Sun motors and heating units have their sphere in California, but not, alas! in Great Britain. Local sources of power are naturally exploited by preference, and influence demand for different types of appliance. Where fuel is scarce and costly the heat pump may be an economic proposition in spite of its high first cost. Under similar circumstances the additional structural complication necessary to attain a high efficiency in any application may be justifiable. Where fuel is cheap a simple cheap appliance of moderate efficiency will suffice.

Fashion and national temperament exert influences which sometimes manifest themselves in surprising forms It is recognised, for example, that in the United States of America the urge to adopt the lastest novelty is greater than in some other countries This leads to a much greater domestic appliance replacement rate than, for example, in Great Britain. Such differences can react on design (in as much as durability is less important in the former country), both materials and methods of manufacture being affected quite apart from whether the change is a genuine improvement or not. Accidental factors, such as the relatively high sulphur content of British coals relative to those of Germany and the United States of America, affect the severity of corrosion problems and determine the quality of materials, which must be used in construction. While mild-steel combustion chambers are usable in regions supplied with fuel of low sulphur concentration, corrosion-resisting steel is necessary when the sulphur content is high. This obviously reacts on cost and on manufacturing technique.

The size of the market for any type of appliance is in itself a major factor in design, determining the extent to which, for example, the incorporation of pressed sheet-metal work is economic, as well as affecting many other details of manufacturing technique, all of which are reflected in style and cost.

Detailed improvements in appliance design result almost automatically from experience in making, selling and using appliances. The progress possible along these lines is limited, and such developments may be likened to the almost imperceptible adaptation which takes place in living species to meet changes in their environment. The really radical changes and mutations in the gas appliance species can only occur as a result of a study of the fundamental principles in the manner which the author has attempted to outline.

TRADE UNIONS AND NATIONALISATION

A DEMAND FOR GREATER CONTROL

TRADE unionists will discuss at the Bridlington congress next week a report on the administration of the nationalised industries which has been published by the General Council of the Trades Union Congress. The report summarises the replies of 27 unions, with members in nationalised industries, to a list of questions on nationalisation sent to them by the T.U.C., sets out a number of proposals which have been made by the General Council to Labour Ministers, and makes it clear that serious differences between trade unions and the Government remain unresolved. The T.U.C. investigation was made by the General Council's Economic Committee, which had had referred to it last year's Margate resolution calling for the appointment of persons 'of proved ability and a belief in nationalisation' to administer nationalised industries. The resolution also demanded extensive training schemes in order to develop the right type of administrative ability.

The General Council states in the report that it has found it necessary to represent 'strongly' to the Government the need for increasing the proportion of members of boards appointed for their trade union experience. This demand is in itself directly opposed to the views of at least one member of the Cabinet, Mr. Gaitskell, who as recently as the Whitsuntide Conference of the Electrical Trades Union maintained that if workers' representatives were to be appointed full time to the boards they would cease thereby to be representative of the workers. The Government has been further informed that while the necessity of making appointments to the boards primarily on the grounds of efficiency and competence is fully recognised by the T.U.C., it is becoming a matter of increasing concern to the trade union movement that belief in a policy of nationalisation should be recognised as a necessary prerequisite of efficient and enthusiastic service.

Growth of Cynicism

During the inquiry on which the report has been based, the unions were told that the General Council favoured the present form of nationalisation, *i.e.*, Ministerial responsibility to the Government for any given industry, Ministerial appointments and formal severance of appointed trade union leaders from their organisations. The replies, however, indicate that it is felt that while consultation machinery 'at the top' is fairly satisfactory, the present system leaves much to be desired lower down in the administrative scale. The National Union of Railwaymen are 'extremely dissatisfied' at not being consulted on matters of major importance; the National Union of Bank Employees complains that it is not recognised at all in the consultative machinery of the Bank of England; and the National Union of Mineworkers says that 'reference is made by some areas to the limited initiative of colliery managers, and due to this there is a growing sense of frustration which is causing a serious deterioration in relations.' What is described as a 'general comment' by the N.U.M. is of particular importance in view of current unrest in the mines and a serious decline in manpower. It says: 'After more than two years of nationalisation, while relationships have to some extent improved, there still remains a good deal of dissatisfaction. The goodwill that has been built up so laboriously since vesting day is being replaced by cynicism.'

Suggested Remedies

One remedy which the General Council has advanced is to secure that, as far as possible, consultative machinery is used before policy decisions have been made by the management, and that consultation is not merely advance notification to workpeople's representatives of policy decisions which have already been taken, or limited to a consideration of secondary decisions arising out of a basic policy already determined. Three further specific demands have been made which, the General Council believes, would ensure a proper attitude towards consultation on both sides of industry. First, 'a proper attitude' should be encouraged by the training of officials as well as workpeople to 'infuse an enthusiasm for the success of the nationalised industry.' Secondly, the re-education of officials with 'long pre-nationalisation experience' is needed so that they 'acquire a sincere desire to consult in the fullest sense of the term with workpeople's representatives.' Thirdly and more tentatively, experiments should be made with schemes whereby trade unions may 'share in the responsibility of considering candidates for promotion.' This, says the report, is being tried to some extent in the Post Office, although the Post Office Engineering Union thinks that it is too soon to say whether the experiment is 'an advance on previous procedure.'

The report contains some surprisingly frank, but gloomy, comments on the attitude of mind to methods of increasing productivity. Discussing the conferences on this problem which have been held with individual unions, the General Council finds 'considerable fear of unemployment and a consequent reluctance to participate in measures to increase productivity.' There was not only a fear of unemployment but also fear of having to leave home to find another job. Where it could be clearly shown that redundant workers could be reabsorbed there was little opposition to trying new methods. In short, the fear of redundancy or unemployment is still far more real in the minds of many workers than all the exhortations to work harder and produce more put out by the Treasury's Economic Information Unit.

NEW HOUSES FOR YOUNG AND OLD

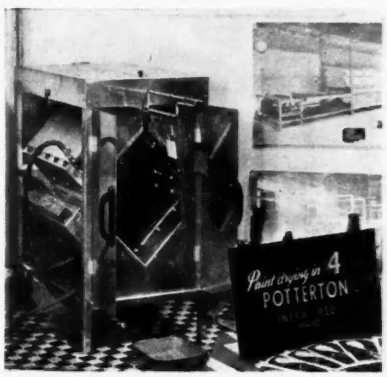
In the port of Newhaven, Sussex, there is rising literally from sea level to 200 ft. a new housing estate called Meeching, the original name of Newhaven before the harbour was built. The estate represents an attempt by the Newhaven Urban District Council to solve the housing problem by building houses to suit a wide range or householders. There is the family type of house with three or four bedrooms, and there is the smaller house with two bedrooms for older people or for single people who wish to share a home.

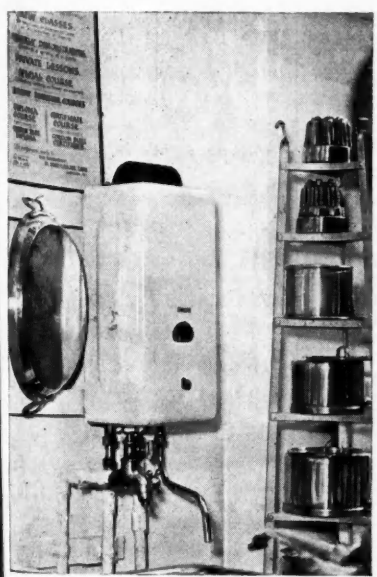
In the kitchen of the family type of house is the latest New World gas cooker and the New World gas wash boiler. The bedrooms are equipped with New World panel gas fires which are practically silent in action. For domestic use, gas is the predominating fuel and the various appliances installed are part of the permanent equipment included in the rent of the house. The estate is being built by local contractors and all the gas appliances are being supplied by the Newhaven undertaking of the South Eastern Gas Board.

The illustration on the left shows the considerable variation of exterior design among the houses on the estate. In the kitchen on the right is a New World gas wash boiler which eases the burden of washing in the family house.

PAINT DRYING

One of the exhibits at the 'Falmouth Can Make It and Sell It' Exhibition, from Aug. 2 to 6, which attracted a great deal of interest was the infra-red paint drying demonstration given on the stand of the South Western Gas Board. An adjustable stoving cabinet manufactured by Thomas De La Rue and Co., Ltd. (Potterton Gas Division), and incorporating four Potterton gas-fired infra-red panels, was used. Paint finishes of various colours were applied to pieces of sheet metal and to small castings and these were dried in the cabinet for four minutes. The demonstration brought home to the public again the many ways in which gas is helping British industry to reach its targets.





This Ewart M 75 sink geyser fitted with swivel spout was selected by the celebrated Cordon Blue School of Cookery for use on its stand at the Schoolgirls' Exhibition at Horticultural Hall, London.

Pilchers, Ltd., paint manufacturers, 6, Chesterfield Gardens, Curzon Street, London, W.1, have published an attractive folder which serves as an introduction to their book entitled *Paint Specifications*. It sets out the basic principles governing the choice of colours in factories, offices and canteens, and provides a practical guide as to suitable methods and materials.

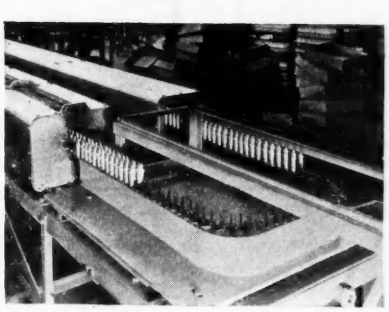
A CRICKET TOUR

The Parkinson team with their hosts at Bath

A cricket team comprising members of the Parkinson Stove Co., Ltd., has just spent a week touring the West Country. Matches were played against the Cheltenham, Weston-super-Mare, Bristol, Exeter, Bath and Bournemouth Divisions of the South Western and Southern Gas Boards. The team was accompanied by various executives of the Parkinson Stove Co., Ltd., and fine weather and the exceptional hospitality of home teams made the trip a most enjoyable affair. The Parkinson Stove Co., Ltd., put out a strong side, and the results were as follows: Beat Cheltenham by nine wickets; beat Bath by 78 runs; beat Exeter by 67 runs; beat Bristol by 66 runs; drew with Weston-super-Mare; lost to Bournemouth by seven wickets.

FIRING OF SPARKING PLUGS

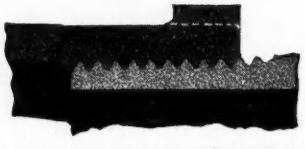
The Champion Sparking Plug Company makes use of a gas infra-red tunnel furnace to bake trade marks on the cores of its plugs. The furnace heat is 1,450° F., a temperature which can be attained in 15 to 20 minutes. The cores, which are carried through the furnace on trident pins, supported by a travelling chain, only need inspection before baking to ensure a satisfactory print. The actual firing time is only about five or six minutes, which means that 4,000 cores per furnace per hour can be produced. This has proved a great advance over the method of production formerly used, owing to the avoidance of complications during the passage through the former process, and consequently the rate of output, both for the home and export market has considerably increased.



Pipes

This gentleman is not an excessive smoker. The solace which tobacco can give is not his aim. He is sending out a call that echoes among the mountains and brings the cattle home at milking time. His pipe is the famous Alphorn. But it is in other pipes that you may be interested—those through which water or gas passes, in which case your thoughts will travel on to Crane malleable iron pipe fittings, which ensure stronger and more reliable pipelines.

Many parallel threads doing no work although wrench-tight. This void is where corrosion starts



See how Crane taper threads make perfect contact. Note the extra metal where threads are cut.

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